

**SEVERITY OF PULMONRY CONTUSION IN BLUNT THORACIC TRAUMA:
ASSESSMENT BY CONVENTIONAL CHEST ROENTGENOGRAPHY – SELF-
EXPERIENCE STUDY**

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ABSTRACT.

Background. Conventional chest roentgenography (CXR) still remains imagine method that is exclusively used in the diagnosis of pulmonary contusion.

The aim of this prospective study is to present the opportunities of conventional chest roentgenograms to determine the severity of pulmonary contusion in blunt thoracic trauma.

Patients and Methods. 139 patients with pulmonary contusion in isolated blunt thoracic trauma were included in this three years retrospective study. The severity of PC was assigned by J. Tyburski's scoring system (BPC-18).

Results. The severity of pulmonary contusion was established as well as: mild (1 – 2 points) – in 41 cases; moderate (3 points) – 23 patients; severe (4 – 9) – 64 patients and very severe (≥ 10) – in 11 patients.

Conclusion. This study confirmed that conventional chest roentgenography allows establishing the extension of pulmonary contusion and using BPC-18 scoring system to determine the severity of this common thoracic injury.

Key words: *pulmonary contusion, blunt thoracic trauma, conventional chest roentgenography.*

Introduction.

Pulmonary contusion (PC) is the most common intrathoracic injury in blunt chest trauma [1,3,4,]. Conventional chest roentgenography (CXR) still remains imagine method that is exclusively used in the diagnosis of pulmonary contusion [6,7,10,11].

The aim of this prospective study is to present the opportunities of conventional chest roentgenograms to determine the severity of pulmonary contusion in blunt thoracic trauma.

Patients and Methods.

139 patients with pulmonary contusion in isolated blunt thoracic trauma were included in this three years retrospective study. The medical records and chest x-rays (CXRs) of the patients were reviewed.

By our protocol, two CXRs were obligatory taken in every patient: the first –in emergency department and the second - at 24th hour of the hospital admission. The typical appearance of pulmonary contusion on CXR was a patchy infiltrate or opacification.

The severity of PC was assigned by J. Tyburski's scoring system (BPC-18)/ [8]. The lung was divided into upper, middle and lower fields. Each field was assigned a score of 1 to 3 on the basis of amount of opacification. In this manner, a contusion encompassing on third of one lung field would receive score 1. A complete opacification of lung field would get score 3. If the entire lung was opacified, it would receive PC score of 9. Thus, a CXR could establish severity of PC between 1 and 18.

Rib fractures, other bony fractures (scapulas, sternum, clavicle) and pleural involvement (hemothoraces, pneumothoraces, hemo-pneumothoraces) were established on CXRs. To avoid false contribution to PC score by hemothoraces and lung compression by a pneumothorax, CXRs were

not scored until hemothoraces and pneumothoraces were drain with chest tubes. Thus, the severity of PC was determined on the base of lung opacification on the second CXR – at 24th hour of hospital admission.

Results.

Rib fractures were established in all of 139 patients with PC. 15 of patients (10,79 %) had one or two fractured ribs. The rest of patients had multiple rib fractures - ≥ 3 , 26 of them with bilateral fractured ribs. The thoracic injuries, associated with PC, that were determined by CXRs are presented in table 1.

| Thoracic injuries, associated with pulmonary contusion – determined by conventional chest roentgenograms / (n – number of patents). Table 1. | | | |
|--|----------|----------|-----------|
| Thoracic injury | n | % | Sp |
| 1. rib fractures | 139 | 100 | - |
| 1.1. one/ two ribs | 15 | 10,79 | 2,63 |
| 1.2. multiple | 124 | 89,21 | 2,63 |
| 1.2.1. unilateral | 98 | 70,50 | 3,86 |
| 1.2.2. bilateral | 26 | 18,71 | 3,31 |
| 2. pneumothorax | 33 | 23,74 | 3,60 |
| 3. hemothorax | 36 | 25,89 | 3,71 |
| 4. hemo-pneumothorax | 24 | 17,27 | 3,20 |
| 5. clavicular fractures | 11 | 7,91 | 2,29 |
| 6. sterna fractures | 6 | 4,32 | 1,72 |
| 7. scapular fractures | 5 | 3,59 | 1,57 |

According to the scoring system of J. Tyburski, quantitative analysis of the pulmonary contusion in blunt thoracic trauma was made. The data are presented in table 2.

The severity of pulmonary contusion was established as well as: mild (1 – 2 points) – in 41 cases; moderate (3 points) – 23 patients; severe (4 – 9) – 64 patients and very severe (≥ 10) – in 11 patients. The distribution of patients according to severe of PC is presented in table 3. Severe and very severe PC was established in all cases with bilateral fractured ribs. Severe PC was determined in patients with 6 and more unilateral fractured ribs.

| Quantitative analysis of pulmonary contusion by BPC-18 scoring system / [n – number of patients]. | | | Table 2 |
|---|-----|-------|---------|
| score of pulmonary contusion | n | % | Sp |
| 1 | 31 | 22,30 | 3,53 |
| 2-3 | 33 | 23,74 | 3,57 |
| 4-6 | 36 | 25,90 | 3,71 |
| 7-8 | 23 | 16,55 | 3,20 |
| 9-11 | 9 | 6,48 | 2,08 |
| ≥ 12 | 7 | 5,04 | 1,85 |
| overall | 139 | 100 | - |

| Distribution of patients according to the severity of pulmonary contusion / [n – number of patients]. | | | Table 3. |
|---|-----|-------|----------|
| severity of pulmonary contusion | n | % | Sp |
| 1. mild | 41 | 29,49 | 3,86 |
| 2. moderate | 23 | 16,55 | 3,09 |
| 3. severe | 64 | 46,04 | 4,23 |
| 4. very severe | 11 | 7,91 | 2,28 |
| overall | 139 | 100 | - |

Discussion.

Pulmonary contusion (PC) is the most common intrathoracic injury in blunt chest trauma [3]. Although there have been many articles written about pulmonary contusion, there has been relatively little effort to quantify the extent of the contusion of the lung in blunt thoracic trauma [1,2,5,8,11]. Following Lord Kelvin's admonition that you cannot really understand phenomena unless you can measure it, our aim in this retrospective study was to quantify the pulmonary contusion.

At first, we have to give the answer of the question why we had chosen CXRs to quantify PC in blunt thoracic trauma. We chose the CXRs as the radiographic test to quantify the pulmonary contusion for several reasons. It is almost universally available and obtained for the thoracic trauma patients. It is also the most likely radiographic test to be repeated at 24 hours after hospital admission, which lends itself to assessing the progressive nature of pulmonary contusion.

The second question was why we had chosen BPC-18 scoring system to quantify the extension of pulmonary contusion. BPC-18 scoring system was designed by J. Tyburski as a result of his great effort to assign a numerical score to determine the extension of the pulmonary contusion. BPC-18 scoring system allows easily, fast and exactly radiographic assessment of PC extension. J. Tyburski had demonstrated that BPC-18 scoring system is also suitable to established correlation between PC and need of ventilator support and patient's death.

The third question was why we had chosen the second CXR – at 24th hour of hospital admission to assess the PC extension. Intraalveolar hemorrhage – pathological finding in PC, produces

homogenous opacification. In some cases with mild PC the opacifications may not be radiographically apparent for up to 24 hours postinjury. Because of other thoracic injuries, associated with PC – especially these with pleural involvement (pneumothorax, hemothorax, hemo-pneumotorax), accurately identification on PC by CXRs will be impossible. Hemothoraces and pneumothoraces must be drain with chest tubes to avoid false contribution to PC score. That’s why accurately radiographically identification on PC extension will be made by the second CXR.

Using conventional chest roentgenography we had accurately established the PC extension and by BPC-18 scoring system the severity of PC was precisely determined. Using BPC-18 scoring system in our future studies we will establish correlation between severity of PC and need of mechanical ventilation, as well as the correlation with the death rate.

Using conventional chest roentgenography we had also established other thoracic injuries, associated with PC. Our data confirmed that rib fractures are the most common injury in blunt thoracic trauma. We established that number of fractured ribs correlates with severity of PC. Other thoracic bony injuries (sternum, clavicle and scapula) are associated with great incidence of PC – 100 % according to our data. We confirmed that scapular fractures are marker of severe and very severe PC - result of mechanical impact on the chest wall with high kinetic energy.

Our data also confirmed that conventional chest roentgenography is the main method in the diagnosis of pleural involvement in blunt thoracic trauma - pneumothorax, hemothorax, hemo-pneumotorax.

Conclusion.

Our retrospective study confirmed that CXR is the mainstay method and method of the first choice in the diagnosis of pulmonary contusion in blunt thoracic trauma patients. This study confirmed that conventional chest roentgenography allows establishing the extension of pulmonary contusion and using BPC-18 scoring system to determine the severity of this common thoracic injury.

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